OIPE
APR 12 2004
PATENT & TRADEMARK OFFICE

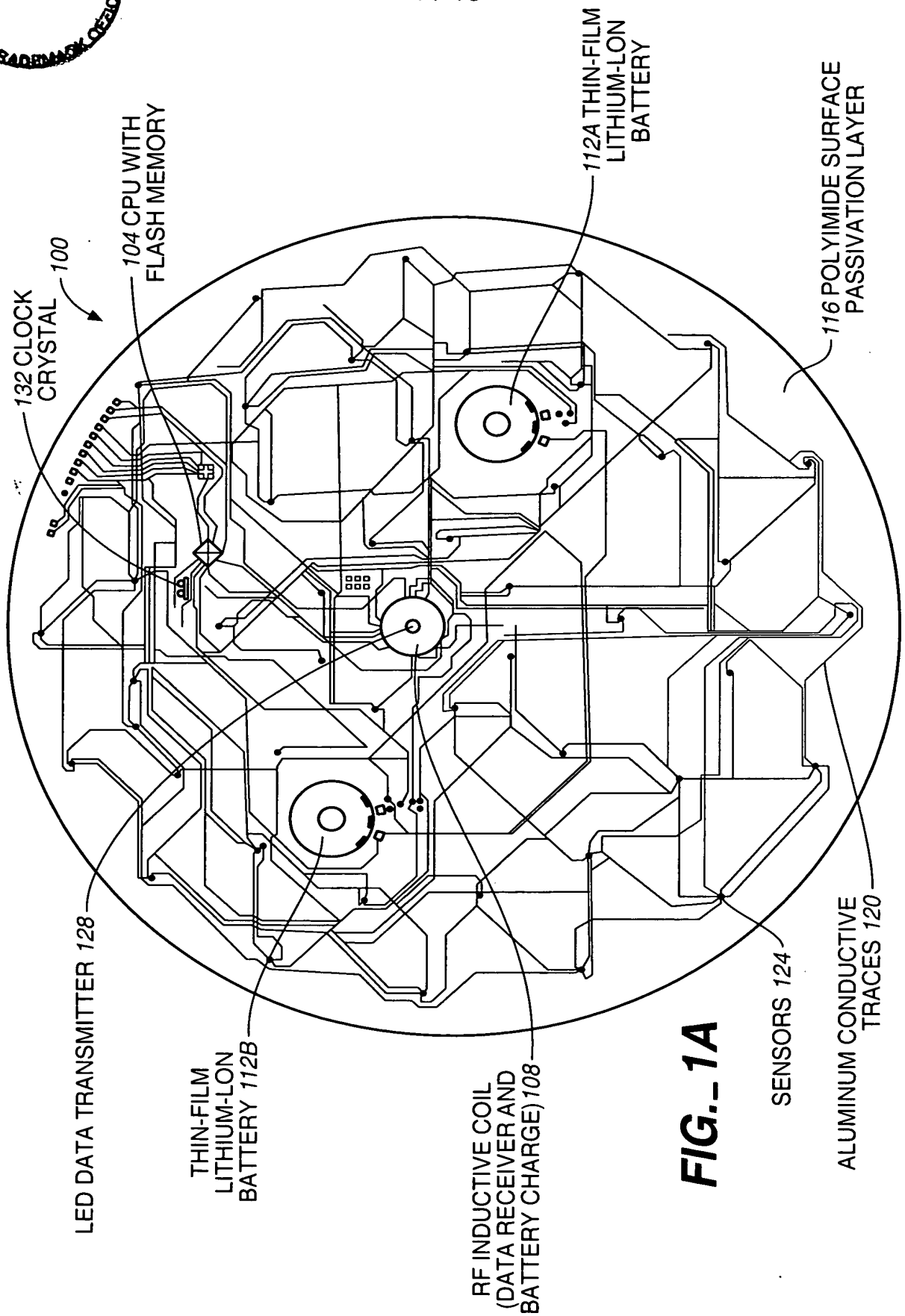


FIG._1A

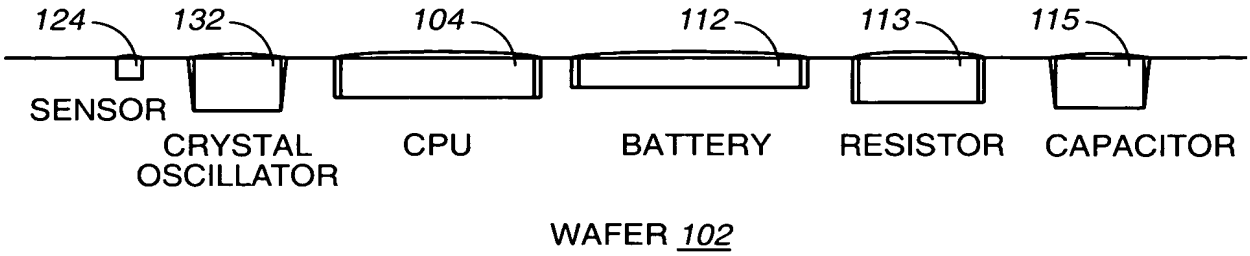

124
132
104
112
113
115
SENSOR
CRYSTAL OSCILLATOR
CPU
BATTERY
RESISTOR
CAPACITOR
WAFER 102

FIG._1B

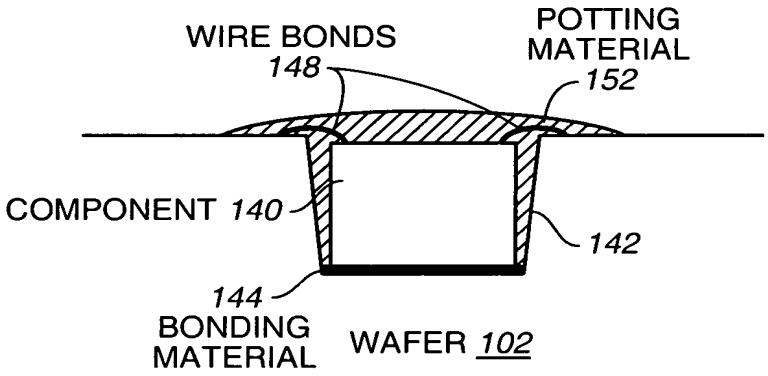

WIRE BONDS
148
POTTING MATERIAL
152
COMPONENT 140
142
144
BONDING MATERIAL
WAFER 102

FIG._1C

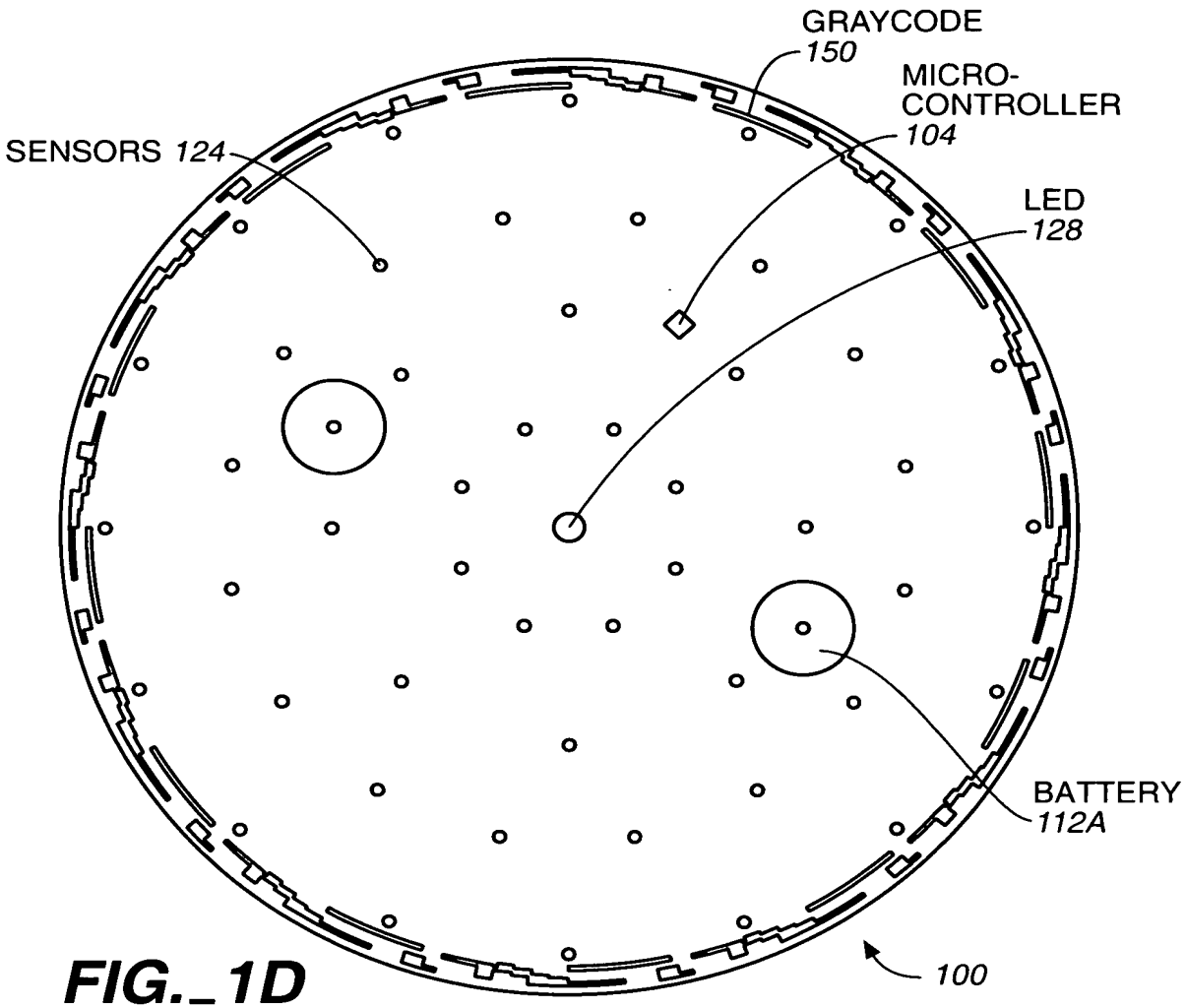

GRAYCODE
150
MICRO-
CONTROLLER
104
SENSORS 124
LED
128
BATTERY
112A
100

FIG._1D

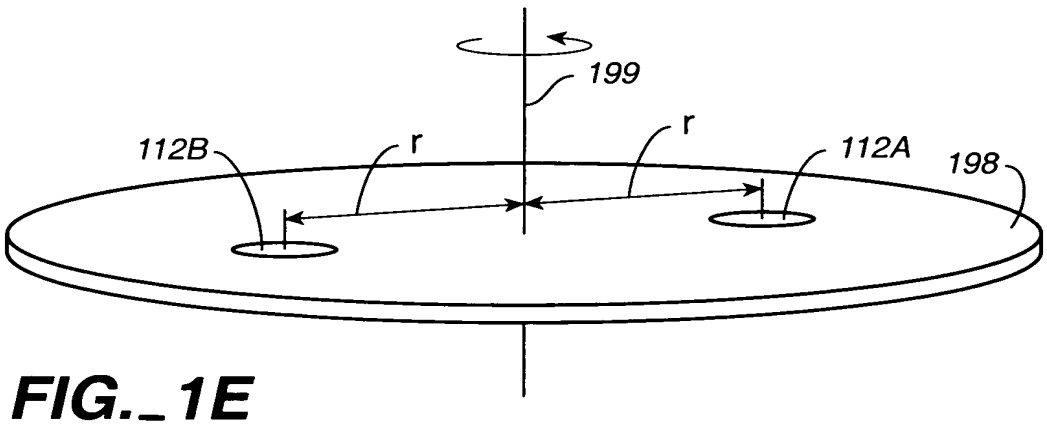

199
112B
r
r
112A
198

FIG._1E

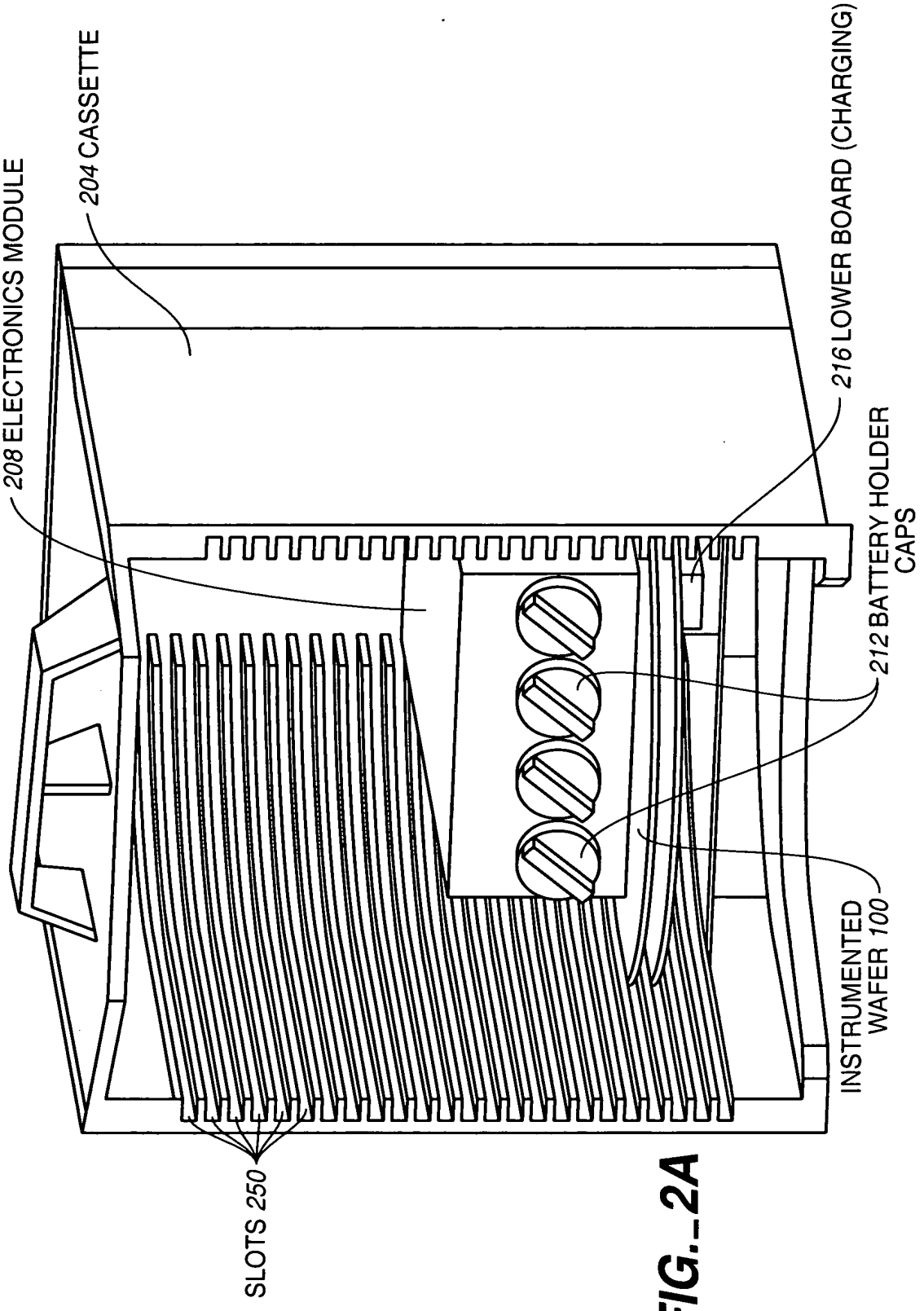

200
208 ELECTRONICS MODULE
204 CASSETTE
216 LOWER BOARD (CHARGING)
212 BATTERY HOLDER CAPS
INSTRUMENTED WAFER 100
SLOTS 250

FIG._2A

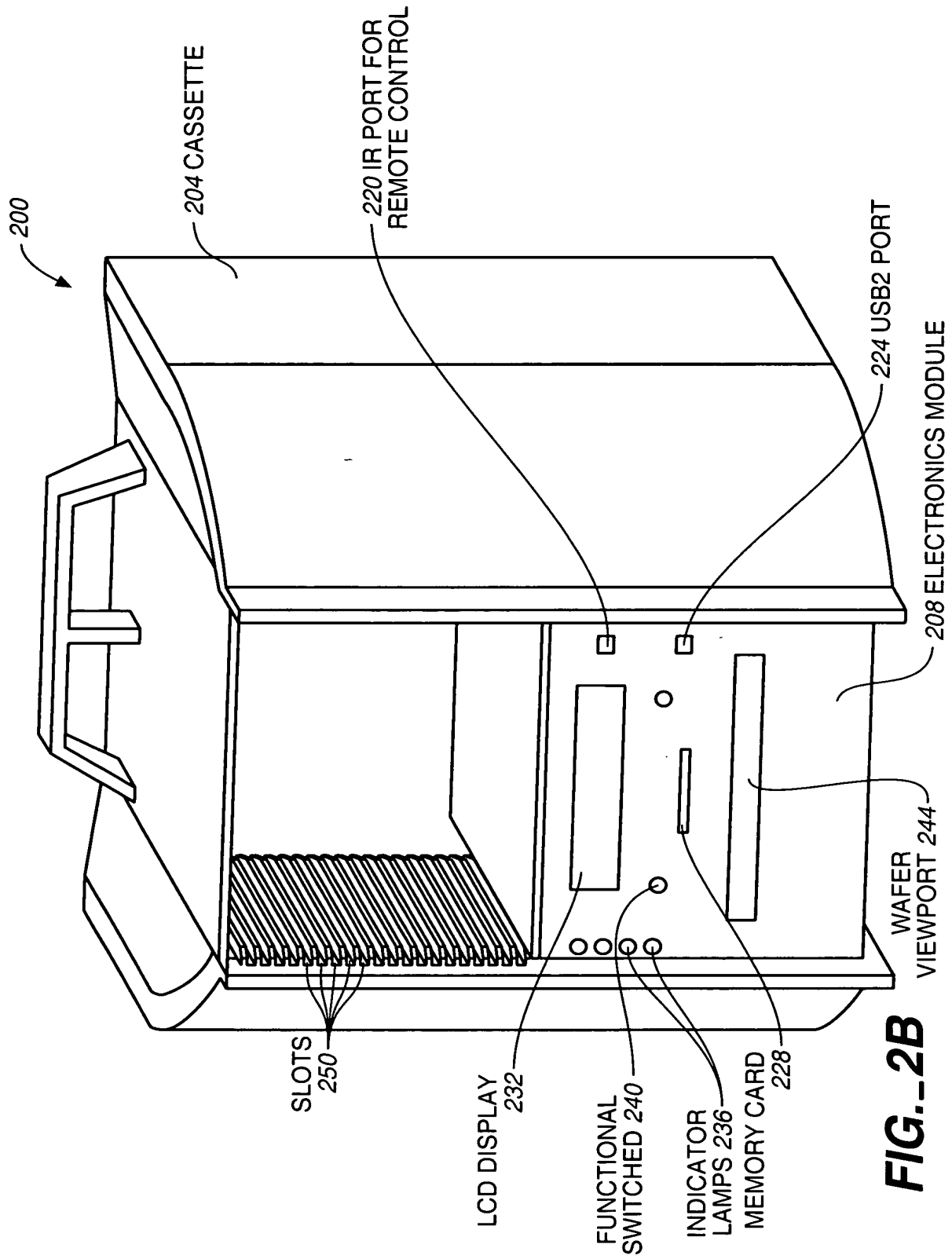

200
204 CASSETTE
220 IR PORT FOR REMOTE CONTROL
224 USB2 PORT
208 ELECTRONICS MODULE
WAFER VIEWPORT 244
SLOTS 250
LCD DISPLAY 232
FUNCTIONAL SWITCHED 240
INDICATOR LAMPS 236
MEMORY CARD 228

FIG._2B

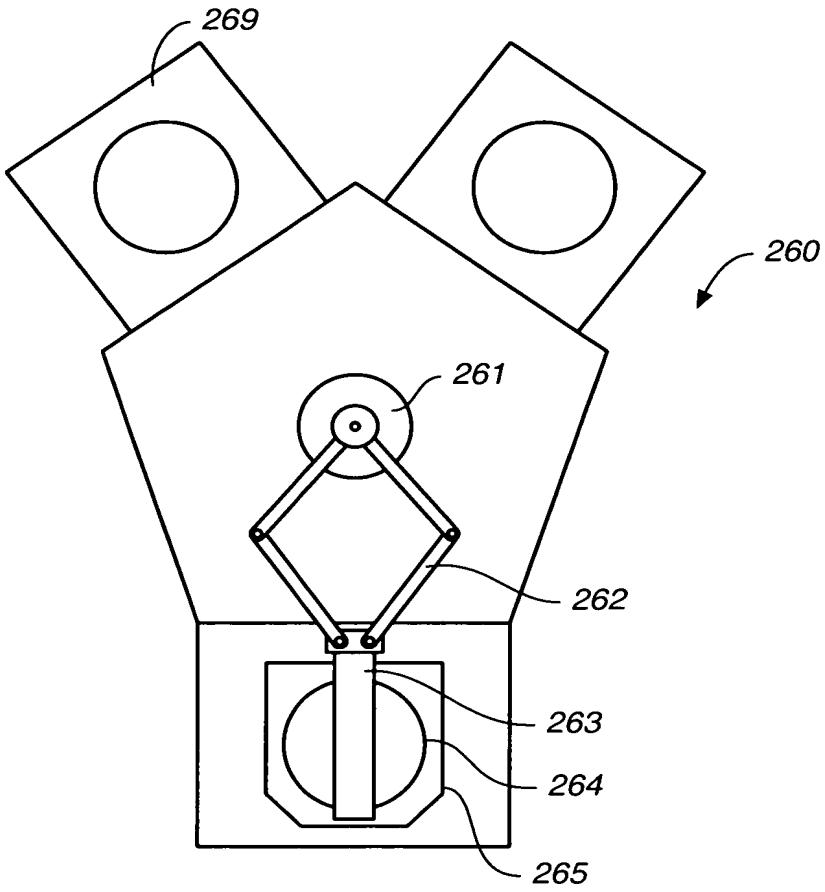


FIG._2C

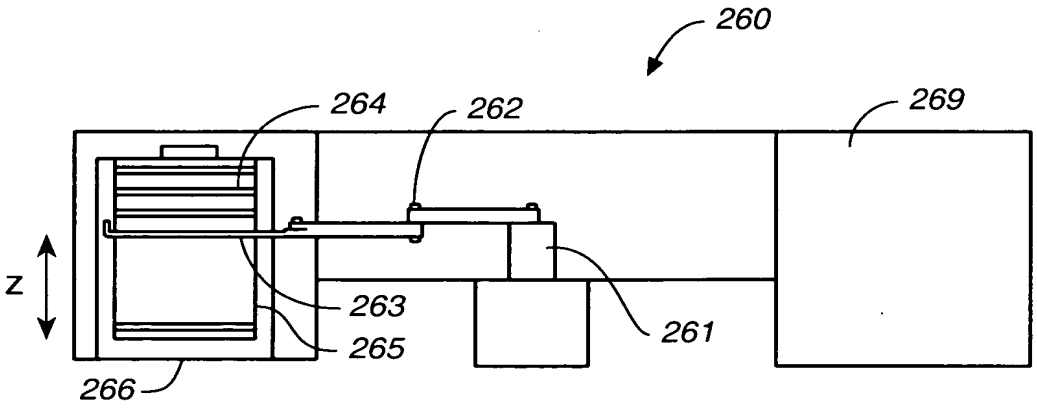


FIG._2D

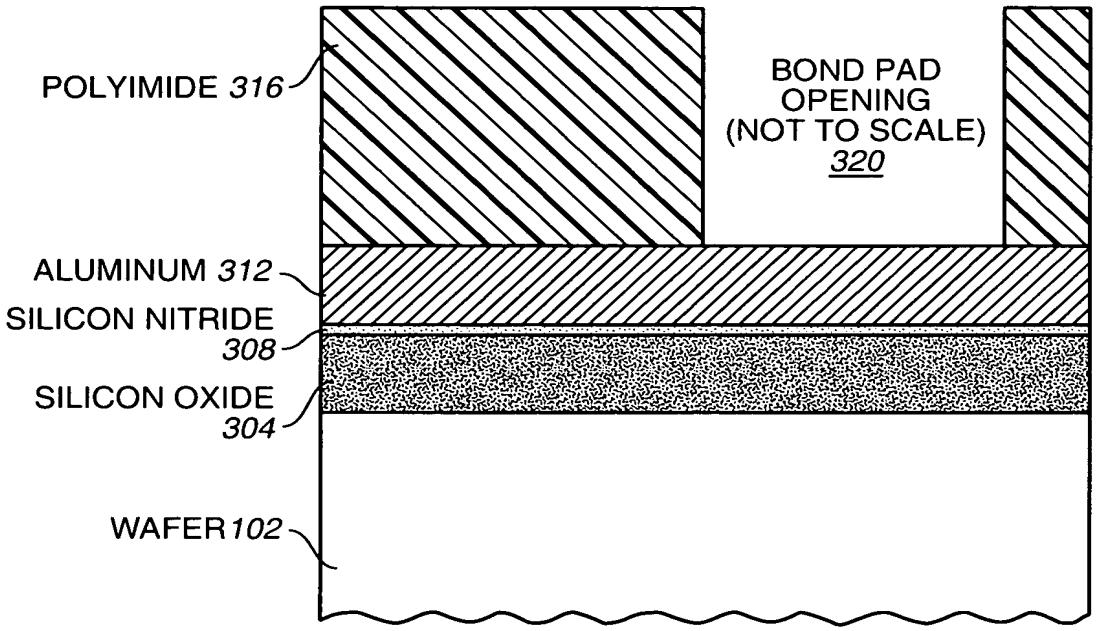

POLYIMIDE 316
BOND PAD OPENING (NOT TO SCALE) 320
ALUMINUM 312
SILICON NITRIDE 308
SILICON OXIDE 304
WAFER 102

FIG._3A

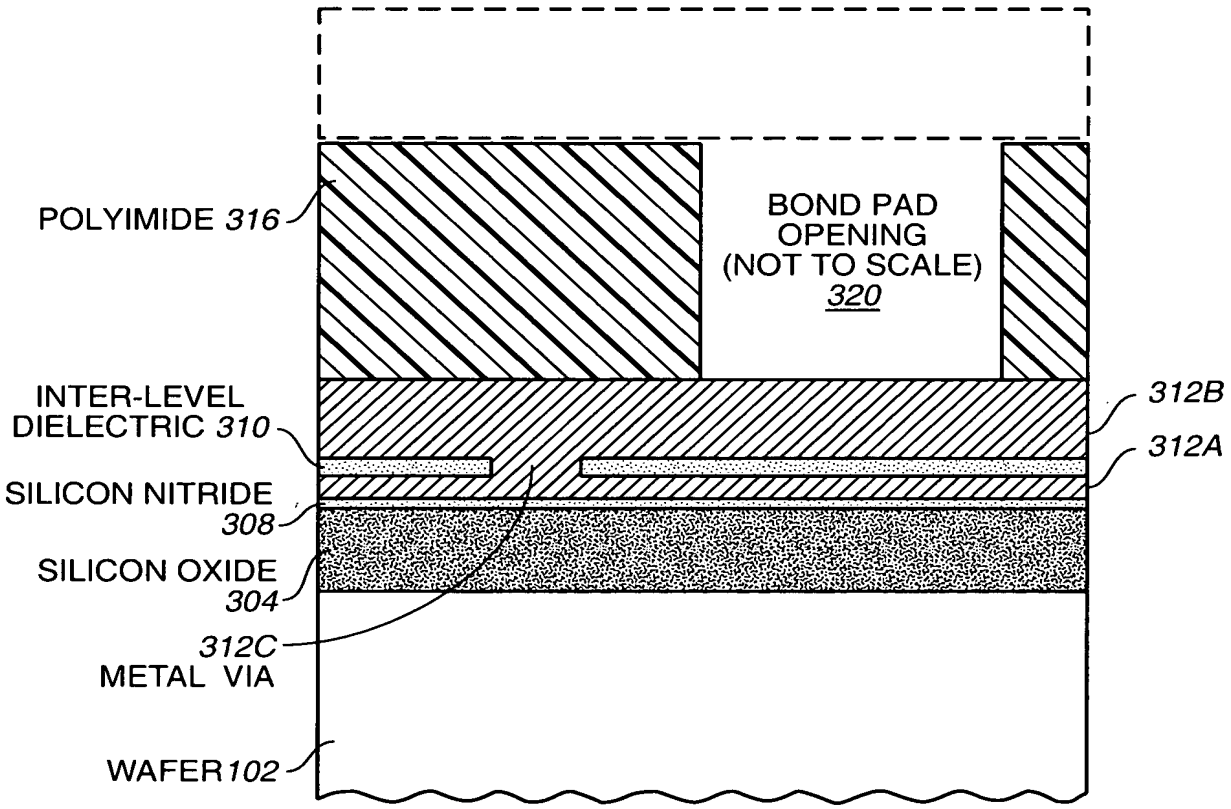

POLYIMIDE 316
BOND PAD OPENING (NOT TO SCALE) 320
INTER-LEVEL DIELECTRIC 310
312B
312A
SILICON NITRIDE 308
SILICON OXIDE 304
312C METAL VIA
WAFER 102

FIG._3B

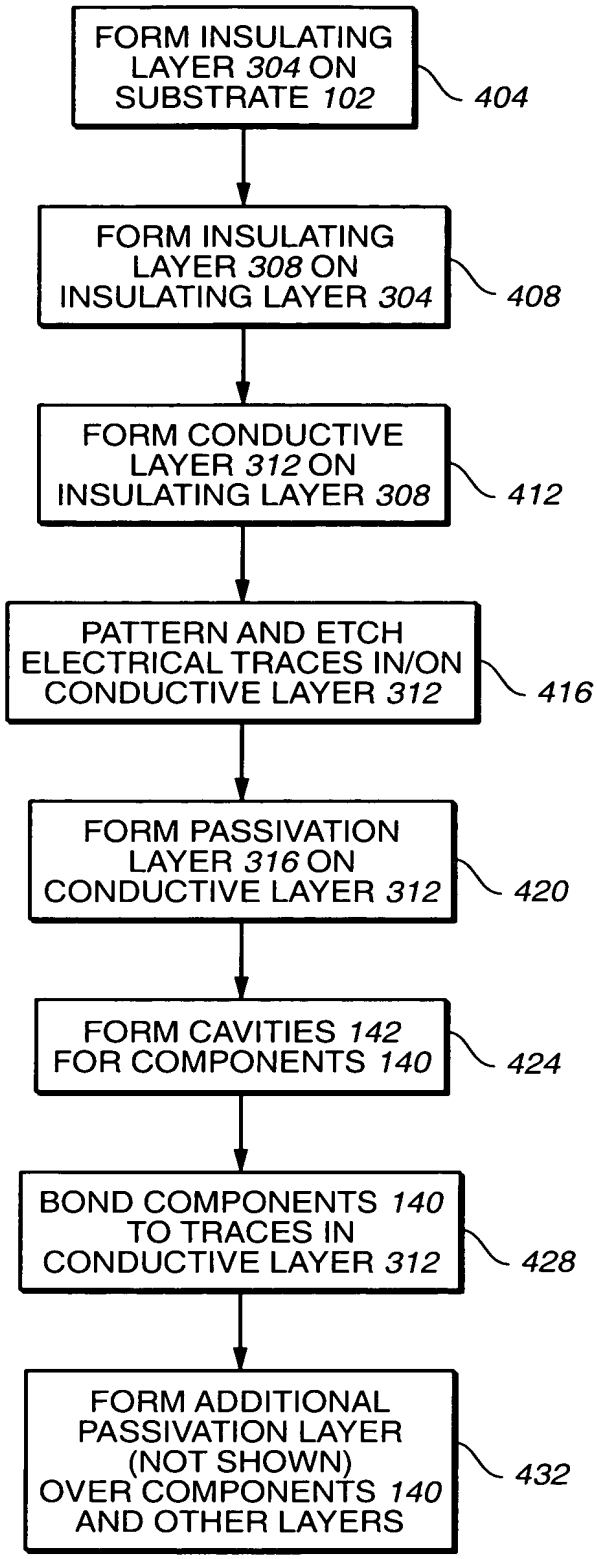

FORM INSULATING LAYER 304 ON SUBSTRATE 102
404
FORM INSULATING LAYER 308 ON INSULATING LAYER 304
408
FORM CONDUCTIVE LAYER 312 ON INSULATING LAYER 308
412
PATTERN AND ETCH ELECTRICAL TRACES IN/ON CONDUCTIVE LAYER 312
416
FORM PASSIVATION LAYER 316 ON CONDUCTIVE LAYER 312
420
FORM CAVITIES 142 FOR COMPONENTS 140
424
BOND COMPONENTS 140 TO TRACES IN CONDUCTIVE LAYER 312
428
FORM ADDITIONAL PASSIVATION LAYER (NOT SHOWN) OVER COMPONENTS 140 AND OTHER LAYERS
432

FIG._4A

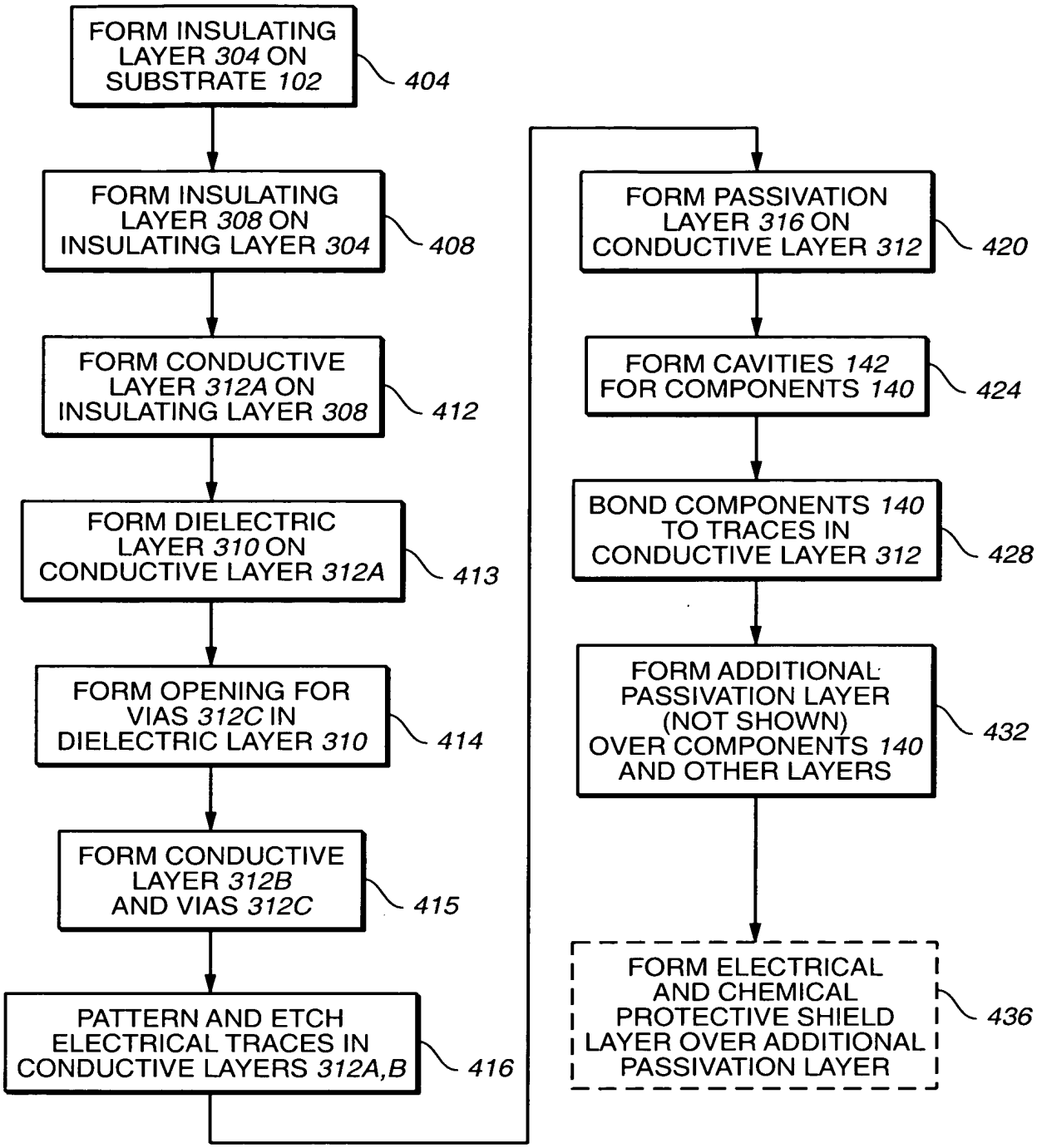

FORM INSULATING LAYER 304 ON SUBSTRATE 102
404
FORM INSULATING LAYER 308 ON INSULATING LAYER 304
408
FORM CONDUCTIVE LAYER 312A ON INSULATING LAYER 308
412
FORM DIELECTRIC LAYER 310 ON CONDUCTIVE LAYER 312A
413
FORM OPENING FOR VIAS 312C IN DIELECTRIC LAYER 310
414
FORM CONDUCTIVE LAYER 312B AND VIAS 312C
415
PATTERN AND ETCH ELECTRICAL TRACES IN CONDUCTIVE LAYERS 312A,B
416
FORM PASSIVATION LAYER 316 ON CONDUCTIVE LAYER 312
420
FORM CAVITIES 142 FOR COMPONENTS 140
424
BOND COMPONENTS 140 TO TRACES IN CONDUCTIVE LAYER 312
428
FORM ADDITIONAL PASSIVATION LAYER (NOT SHOWN) OVER COMPONENTS 140 AND OTHER LAYERS
432
FORM ELECTRICAL AND CHEMICAL PROTECTIVE SHIELD LAYER OVER ADDITIONAL PASSIVATION LAYER
436

FIG._4B

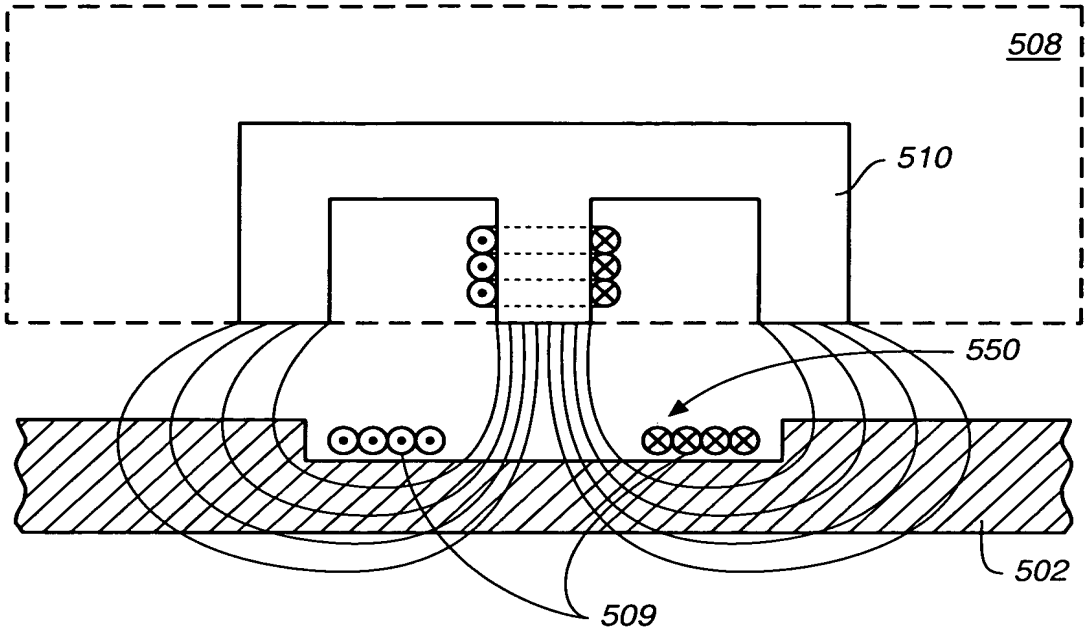


FIG._5A

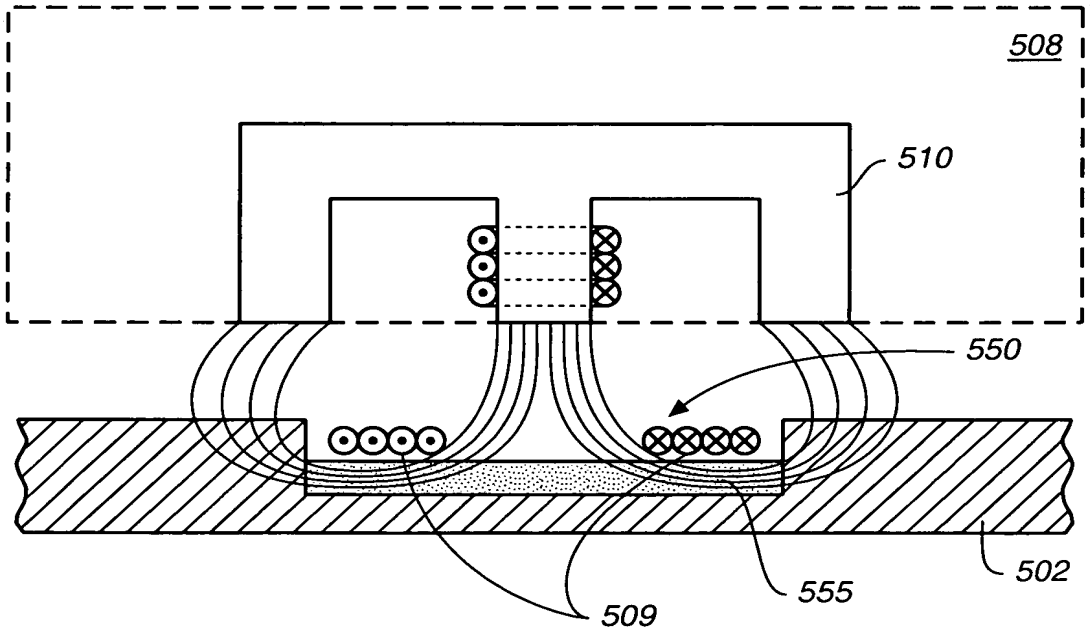


FIG._5B

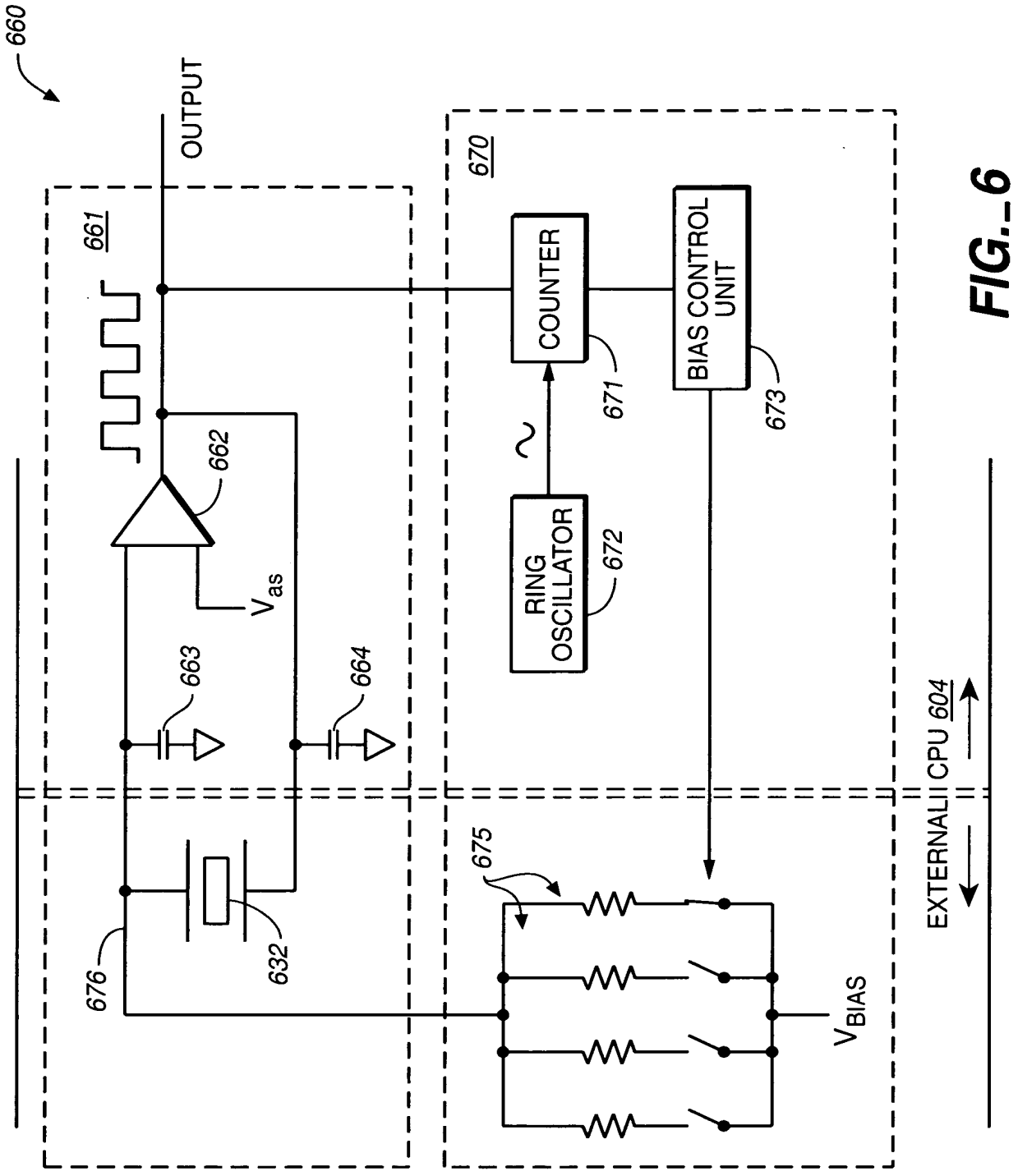

660
OUTPUT
661
662
V_{as}
663
664
632
676
670
COUNTER
671
BIAS CONTROL UNIT
673
RING OSCILLATOR
672
675
V_{BIAS}
EXTERNAL I/I CPU 604

FIG._6

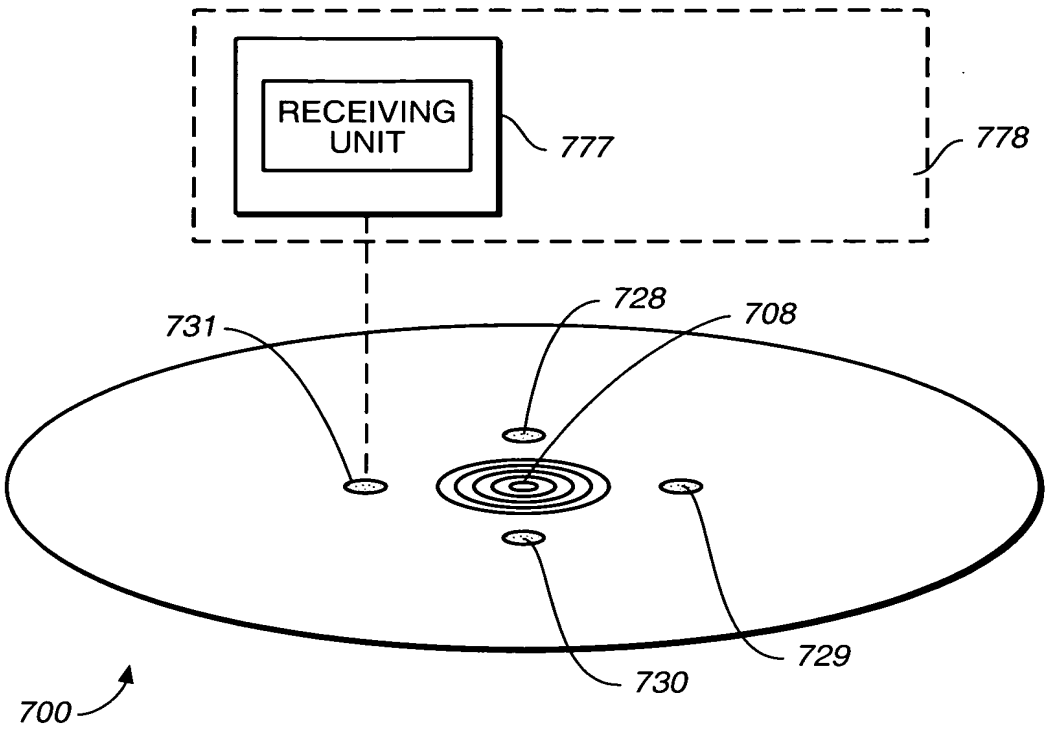


FIG._7

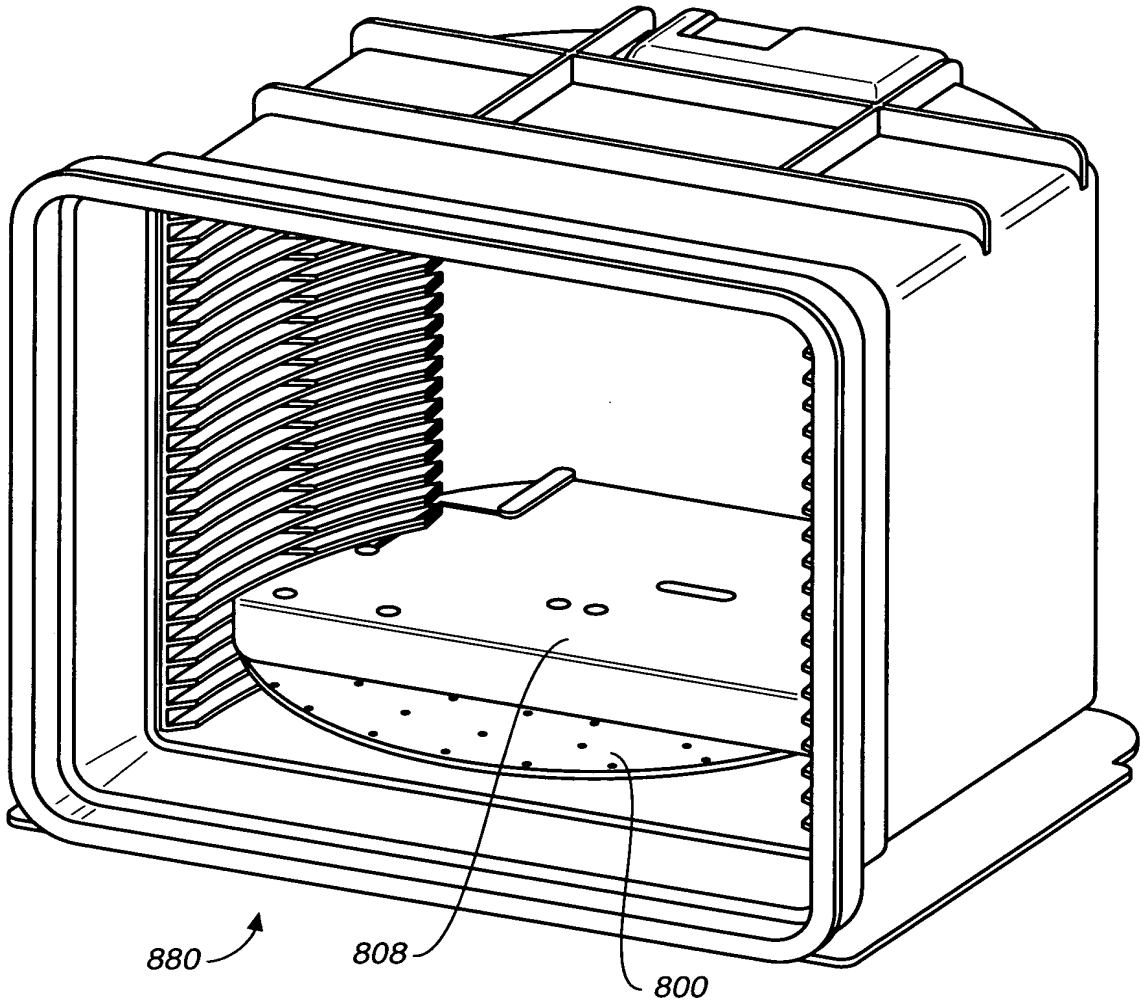


FIG._8A

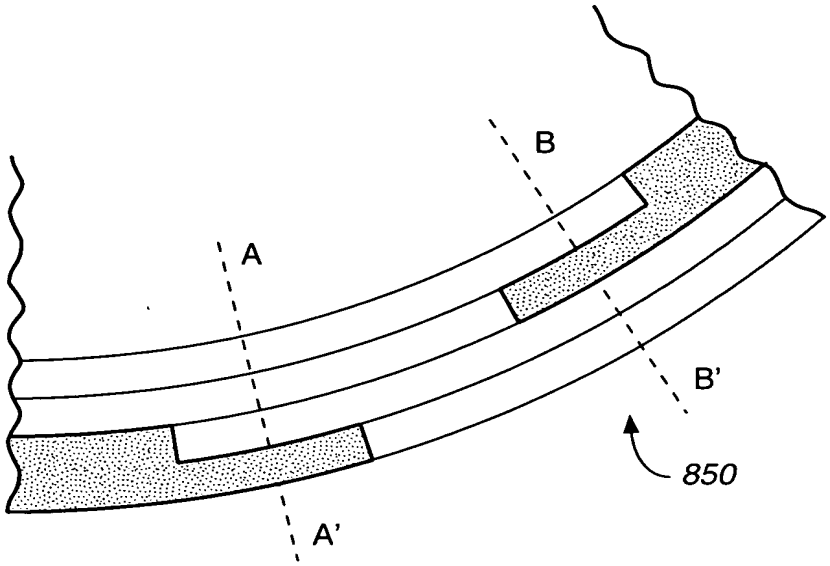

B
A
B'
850
A'

FIG._8B

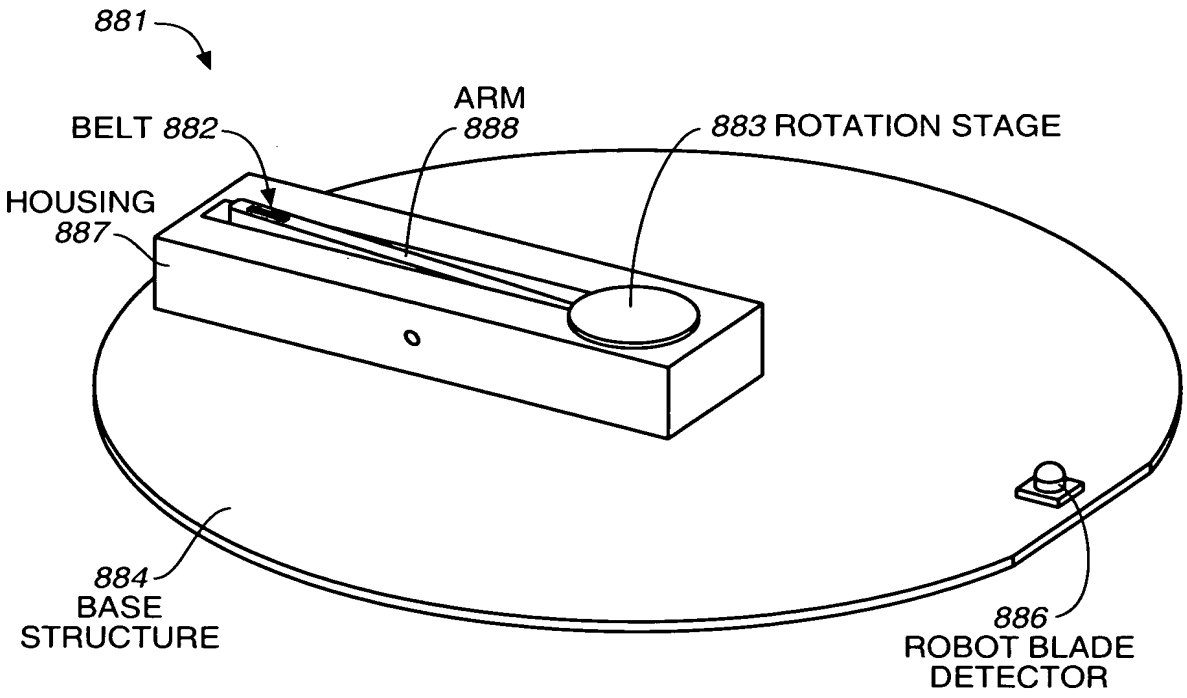
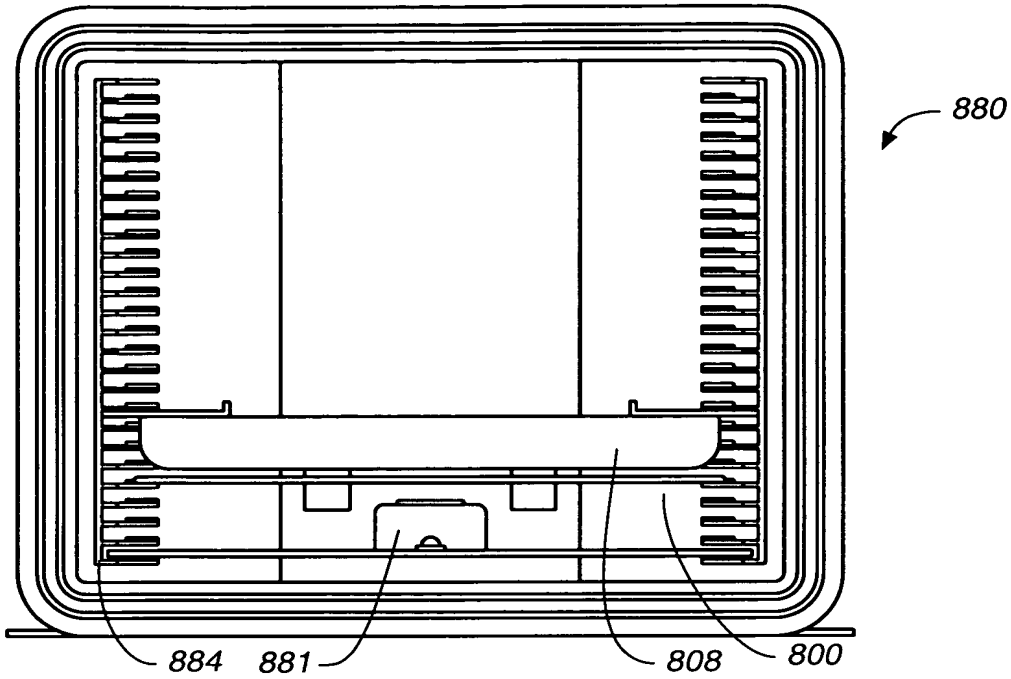
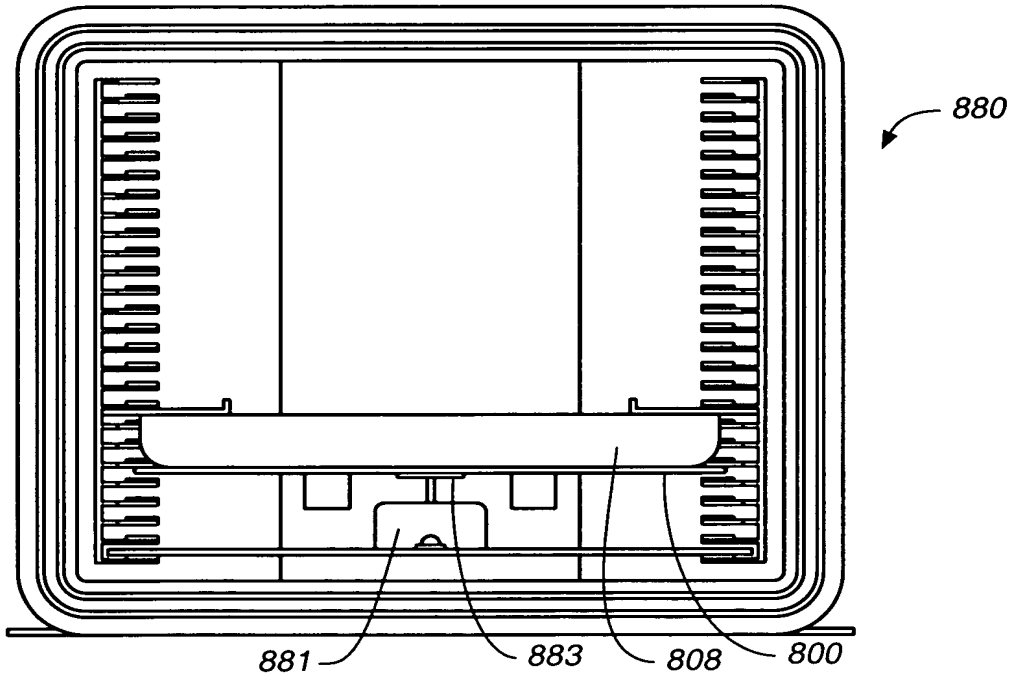

881
ARM
888
BELT 882
883 ROTATION STAGE
HOUSING
887
884
BASE
STRUCTURE
886
ROBOT BLADE
DETECTOR

FIG._8C



WAFER IN SLOT READY TO PICK UP

FIG._8D



WAFER RAISED FOR ROTATION ALIGMENT AND CHARGING

FIG._8E

FIG._8F

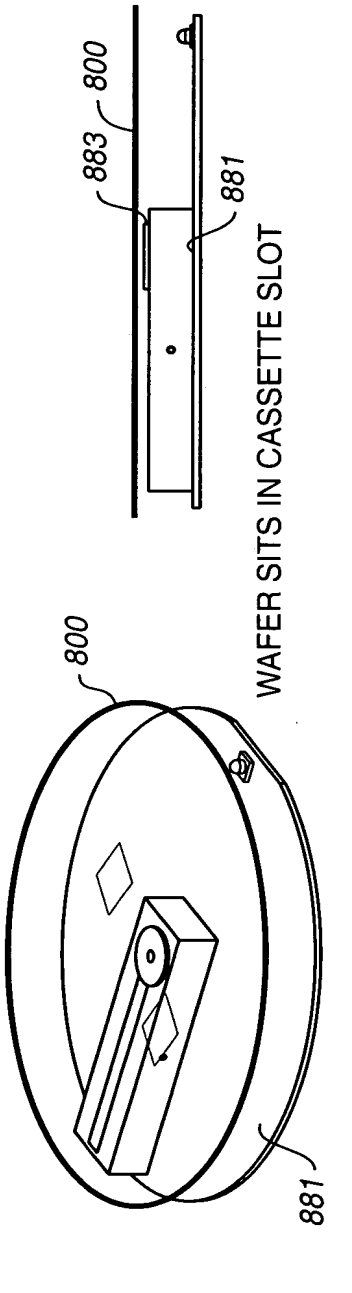


FIG._8G

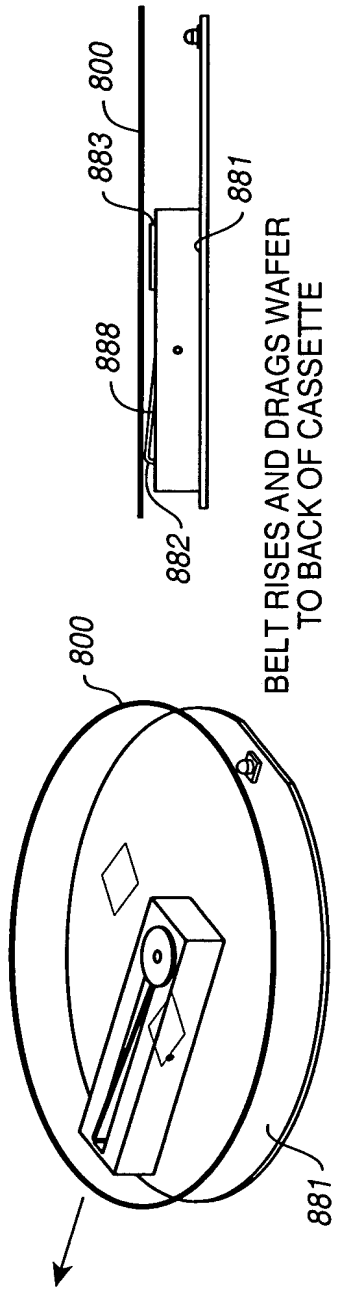


FIG._8H

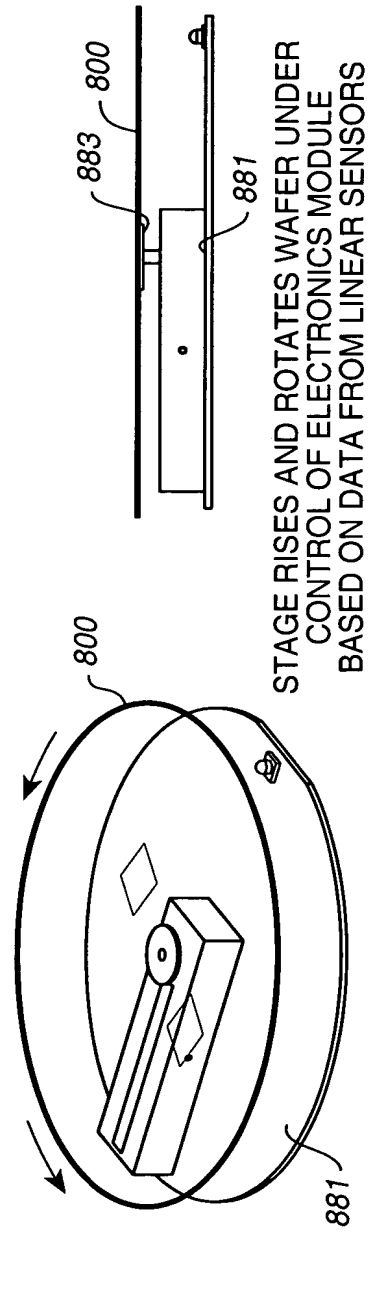
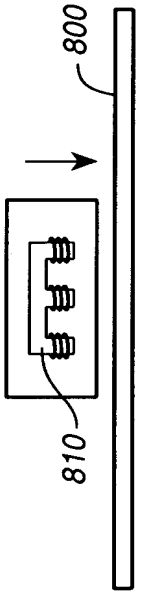


FIG._8I



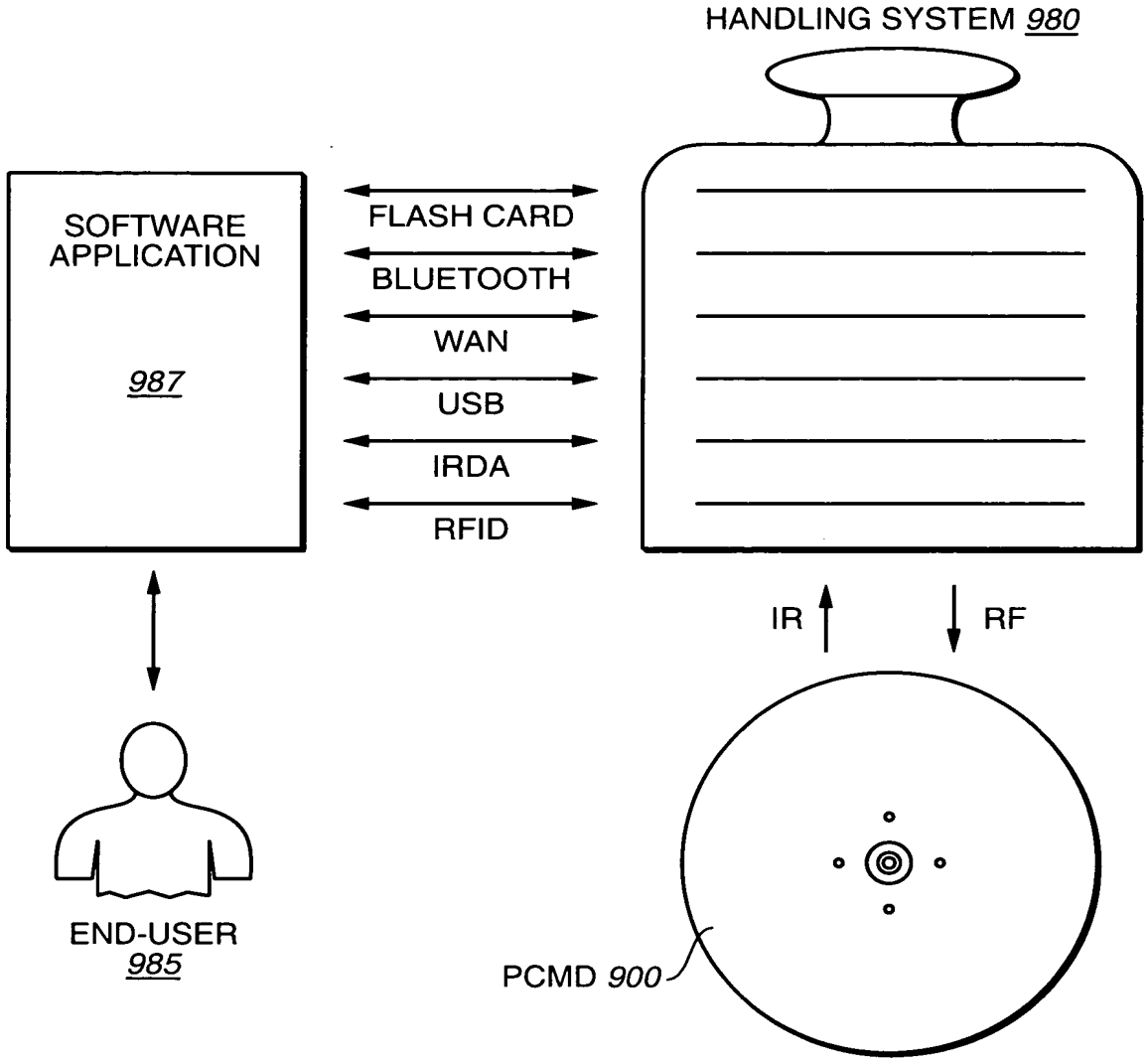

HANDLING SYSTEM 980
SOFTWARE APPLICATION
987
FLASH CARD
BLUETOOTH
WAN
USB
IRDA
RFID
IR
RF
END-USER
985
PCMD 900

FIG._9

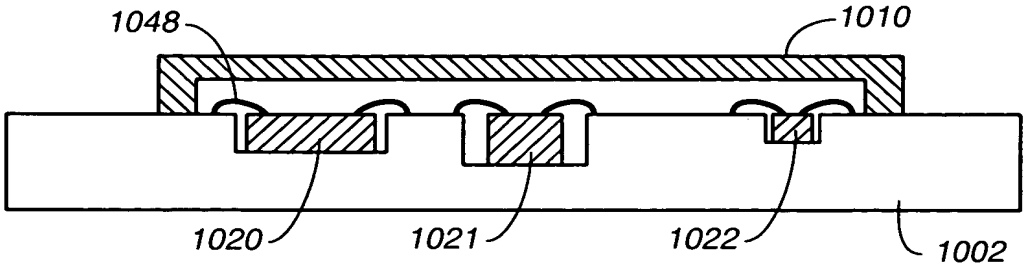


FIG._10A

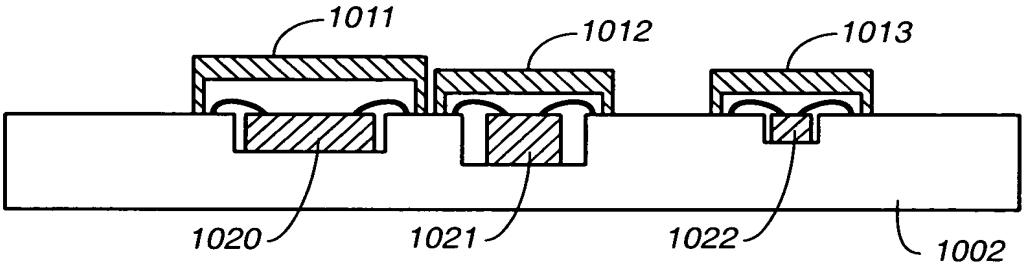


FIG._10B

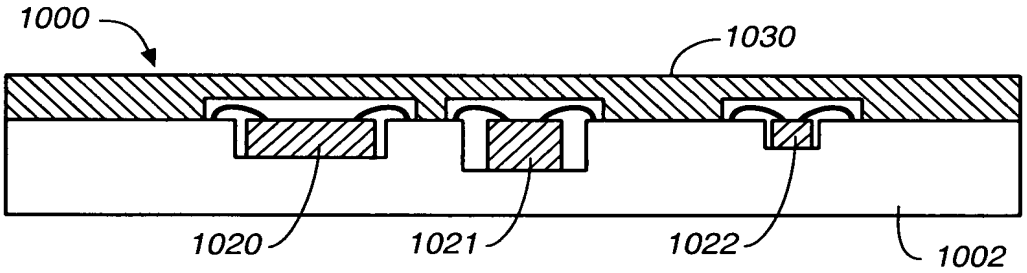


FIG._10C

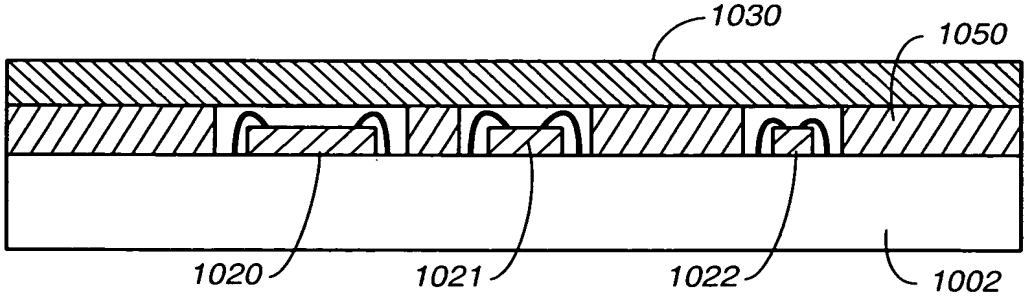


FIG._10D